

ARES Engine Competitive Market Assessment

ARES Peer Review

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Overview

- Evaluate the commercial attractiveness of the ARES technologies compared to current and future competing DG technologies.
- Evaluation of actual future market potential to follow as second task.

ARES 2010 Performance Goals

- 500 to 6,500 kW
- 45% (2005) to 50% (2010) electrical efficiency
- 0.1 g/bhp-hr NO_x (0.3 lb NO_x/MWh)
- 10% reduction in cost of power
- Improved reliability, availability, maintainability.

Competing DER Technologies

- Conventional Engines
- Small Turbines
- Microturbines
- Fuel Cells
- Solar
- Wind

Market Issues - Now and Future

- Output capacity
- Physical size
- Capital cost
- Cost of electricity
- Operating cost
- Emissions
- CHP potential
- Lifetime
- Durability
- Serviceability
- Consumer acceptance

Applications

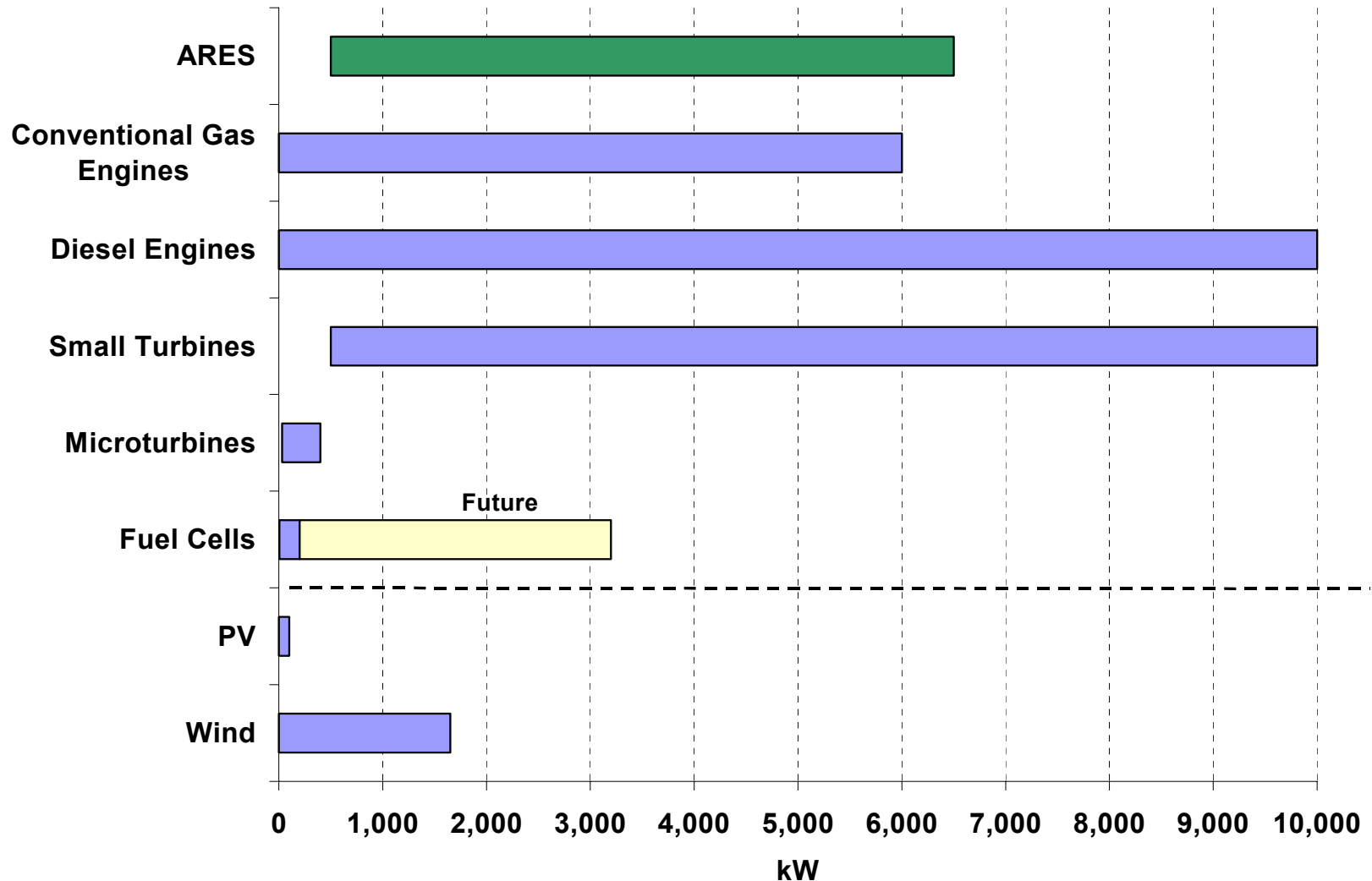
- Base load with or without CHP
- Peak shaving
- Power quality/reliability
- Emergency standby

Technology/Applicability Matrix

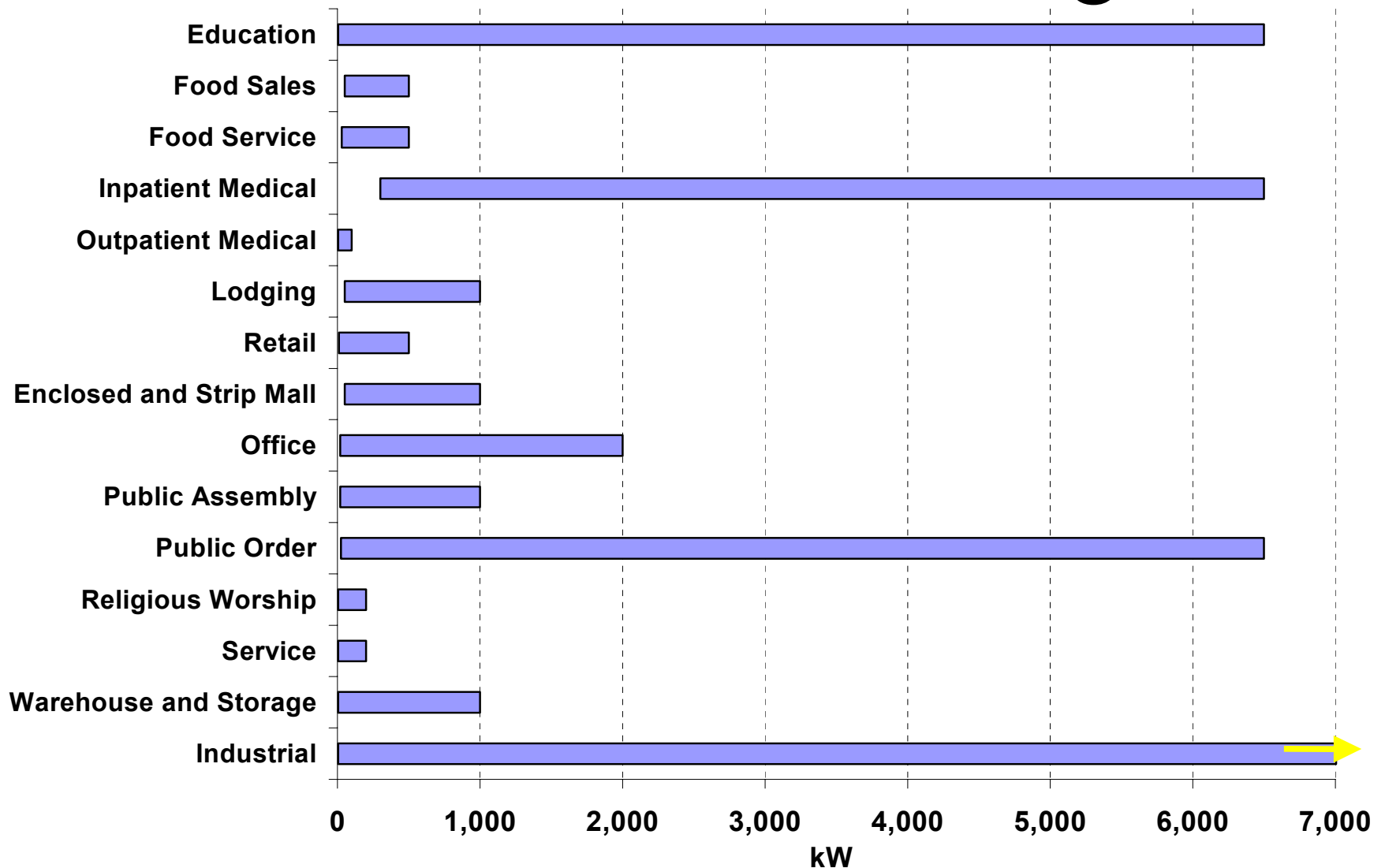
	Baseload	Peaking	Emergency	CHP	Quality/Reliability
ARES	Y	Y	L	Y	Y
Gas Engines	Y	Y	L	Y	Y
Diesel Engines	Y	Y	Y	Y	Y
Small Turbines	Y	Y		Y	Y
Microturbines	Y	Y		Y	Y
Fuel Cells	Y			Y	Y
PV	L	L			L
Wind	L	L			L

Y=Yes, L=Limited

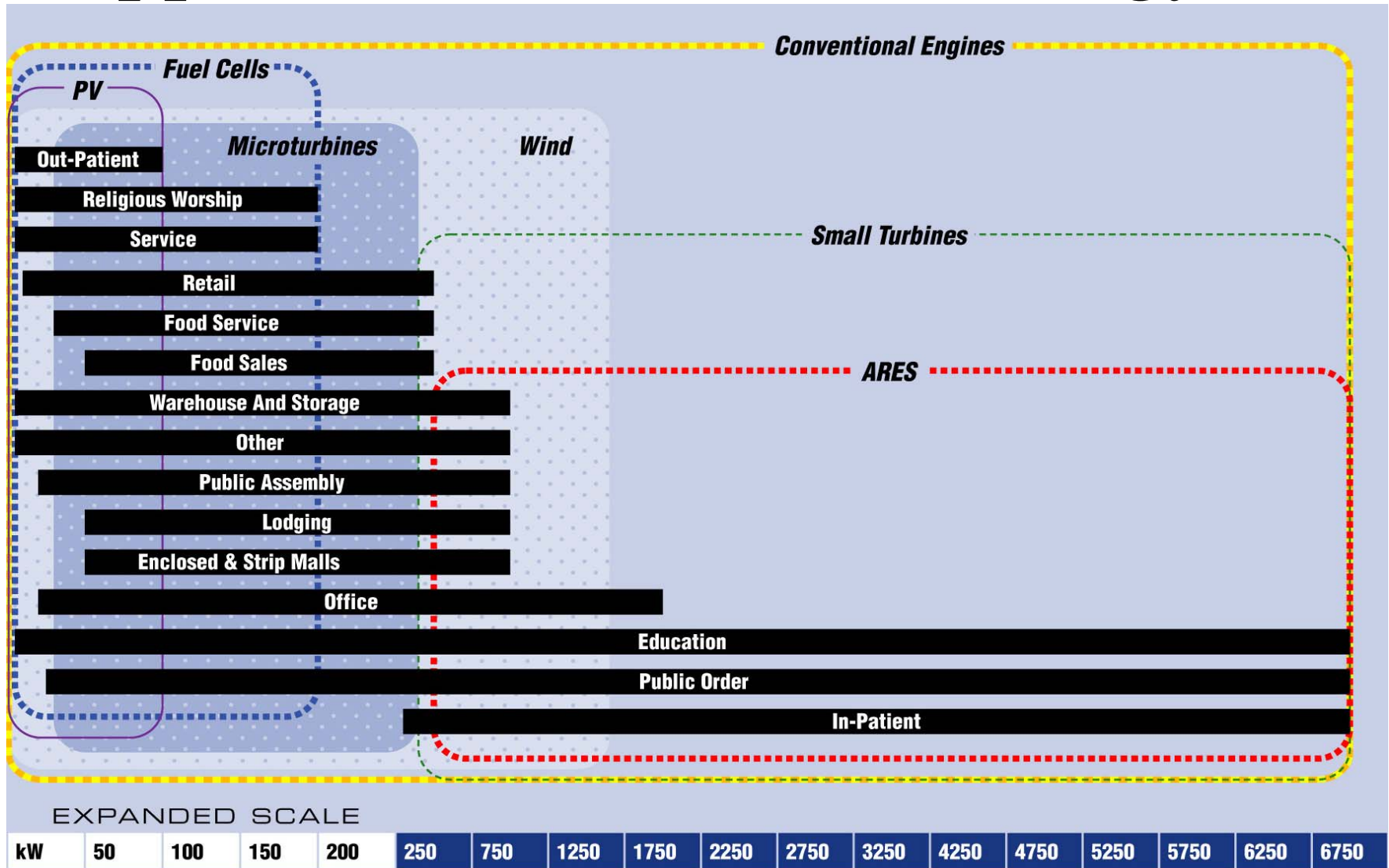
Technology Output Range



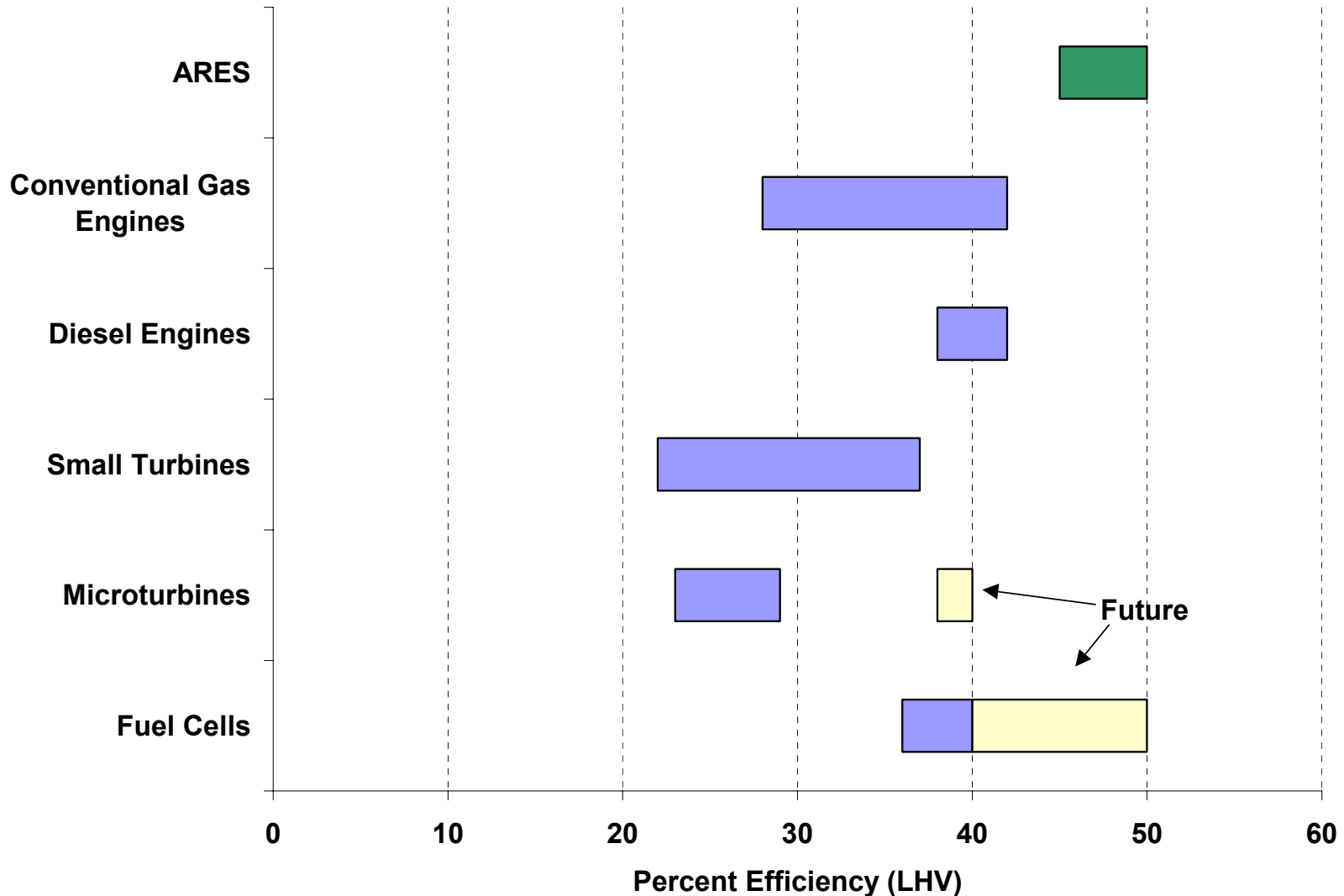
End-Use Electric Load Range



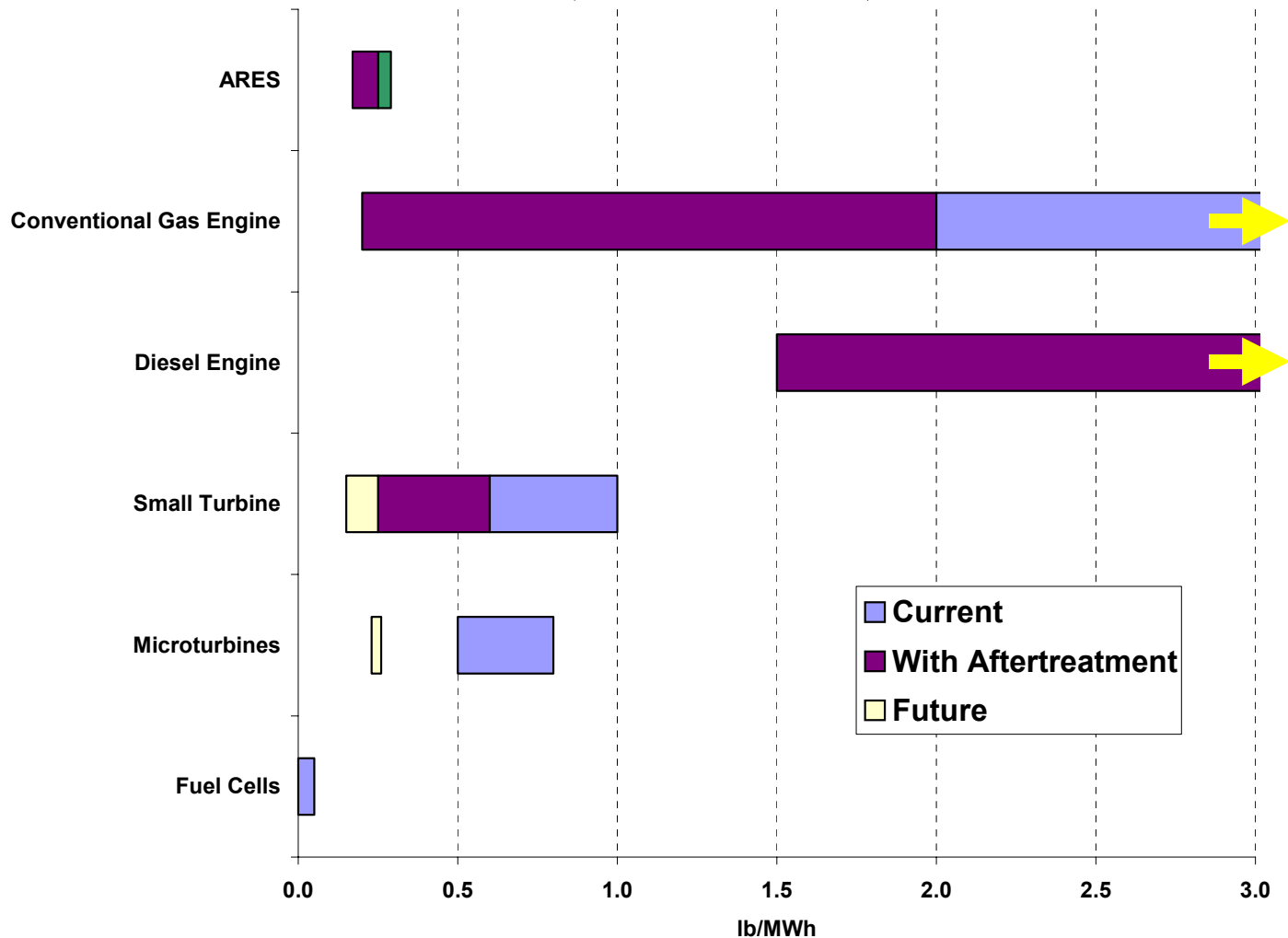
Application vs DG Technology



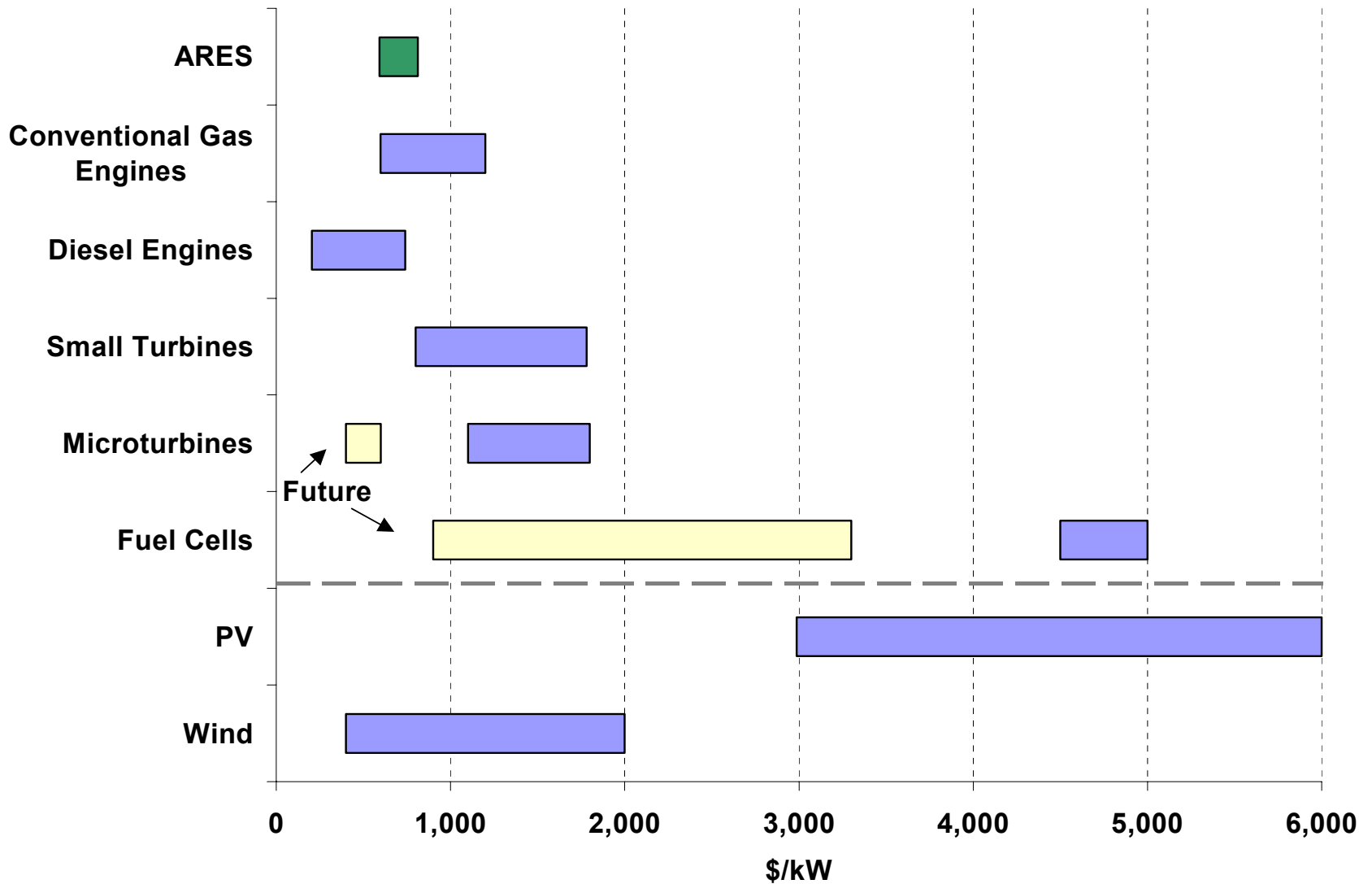
Technology Efficiency Comparison



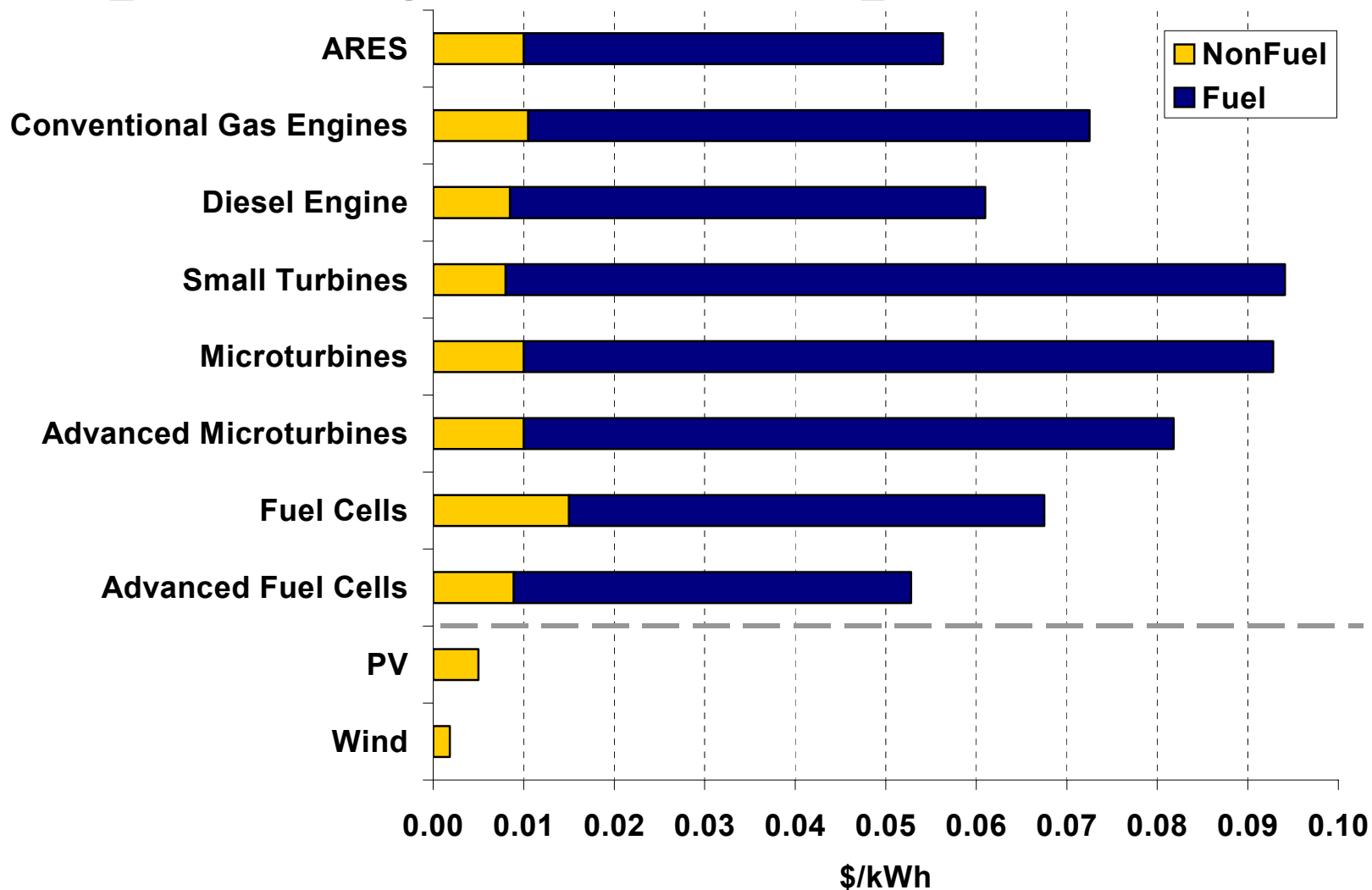
NO_x Emissions Comparison (Baseload)



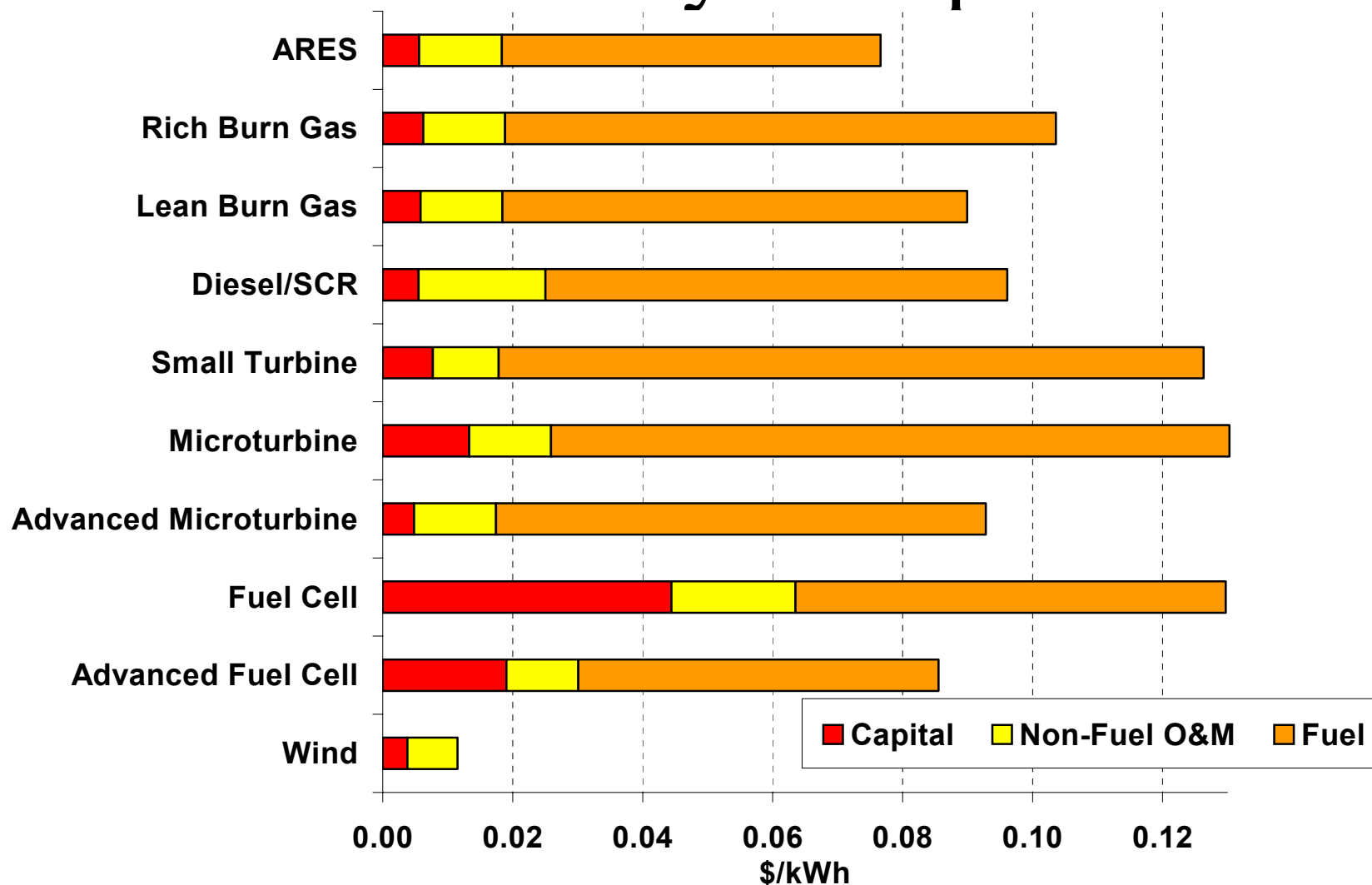
Installed Cost Comparison



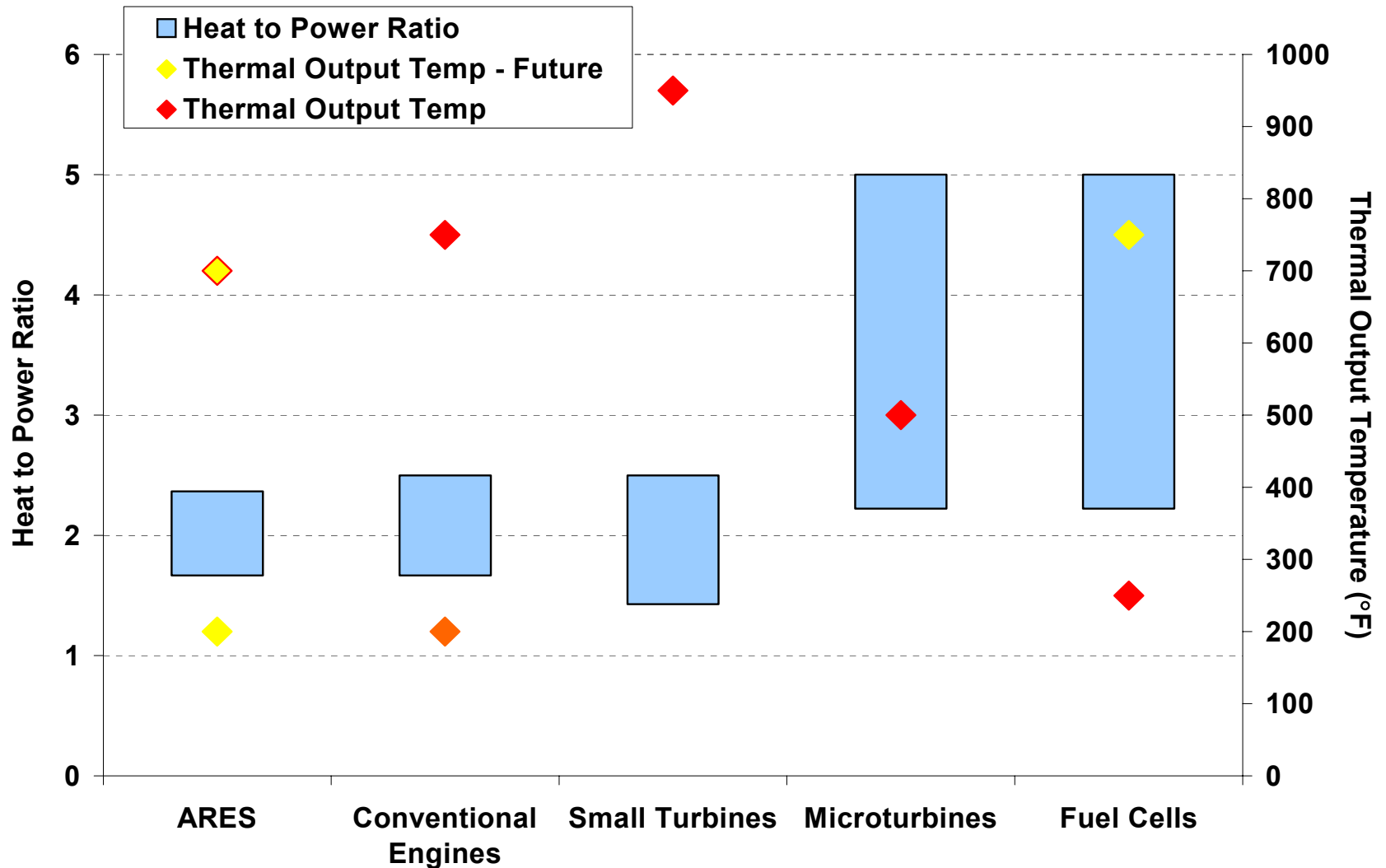
Operating Cost Comparison



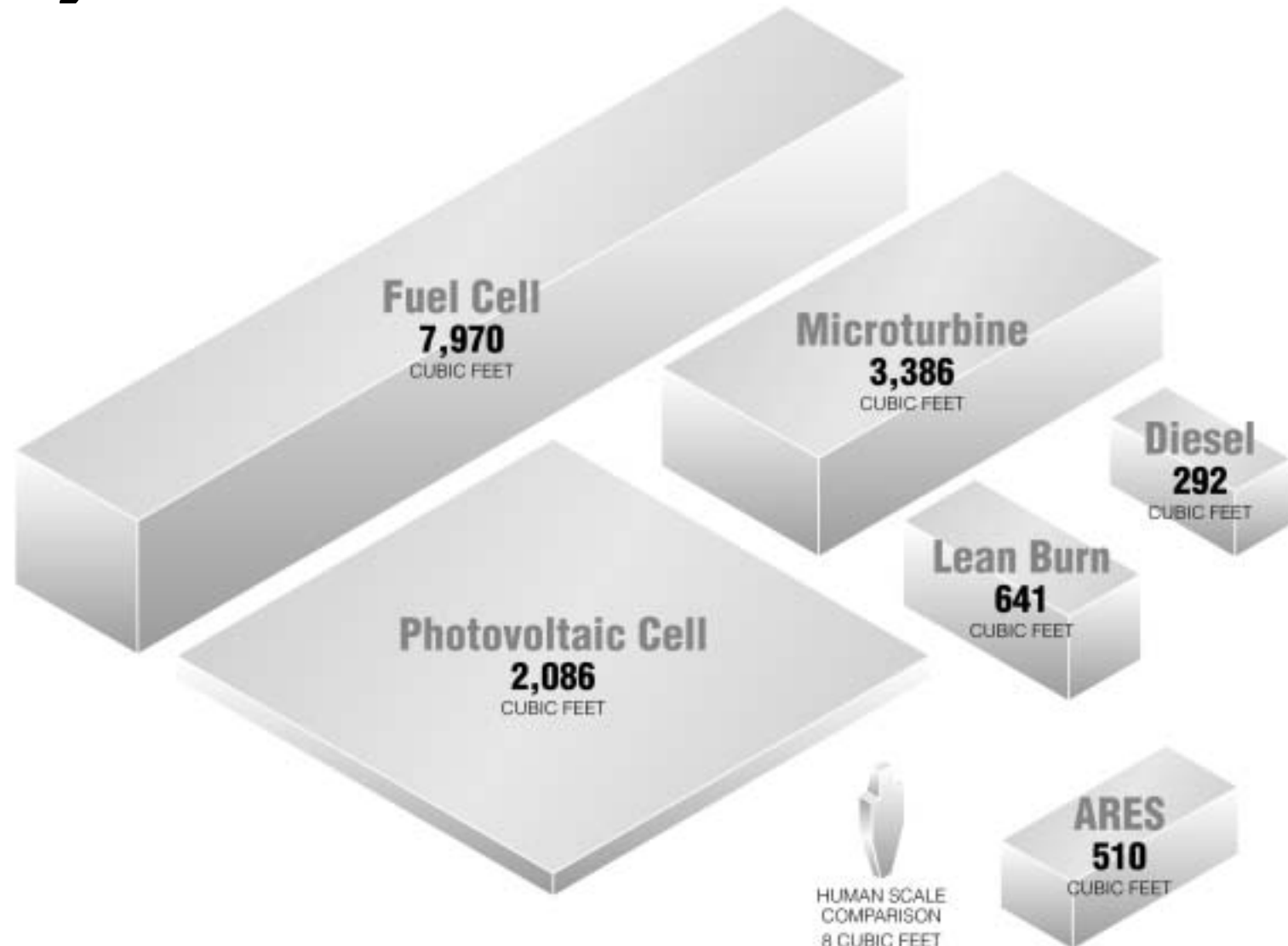
Cost of Electricity Comparison



CHP Characteristics



Physical Size - 500 kW Generator

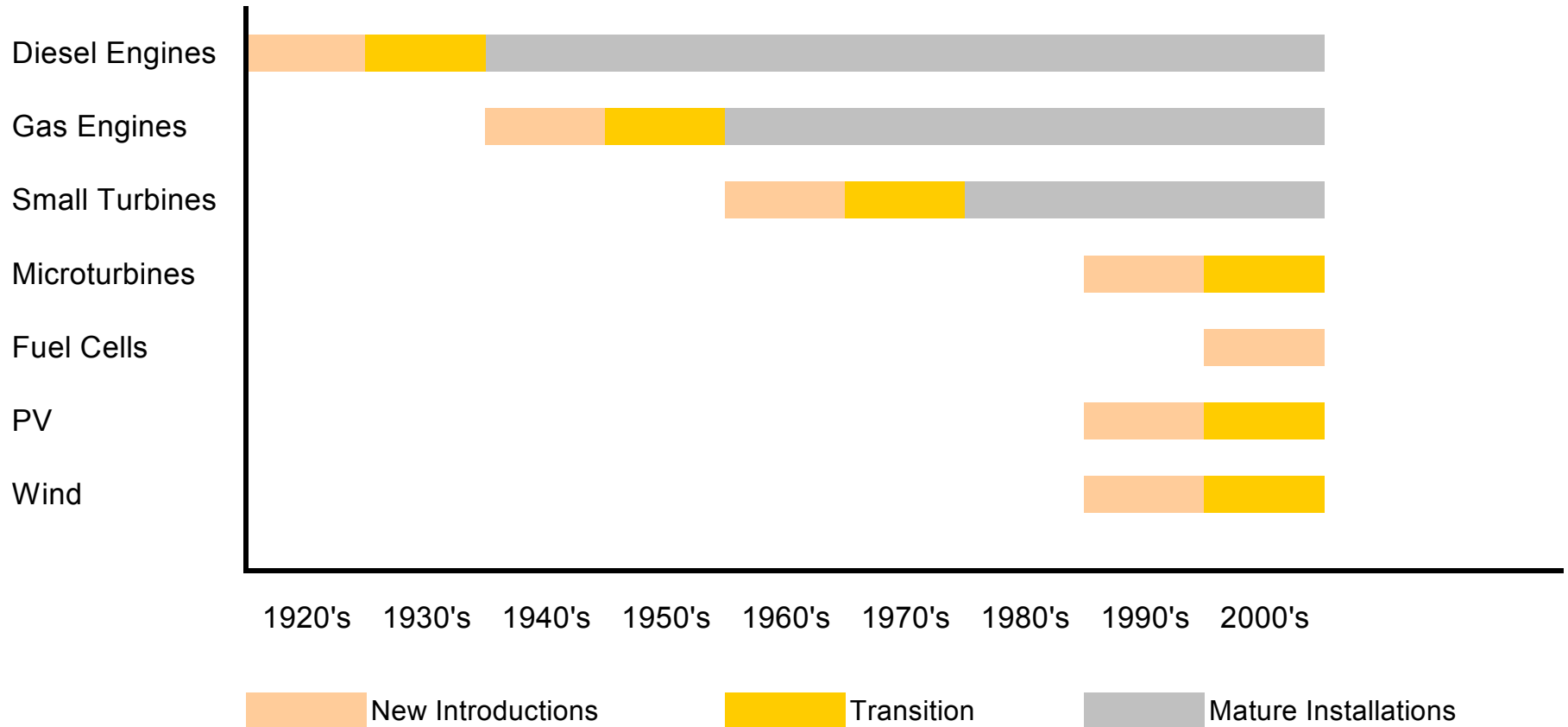


Service Requirement Expectation

(Mature Baseload Technologies)

	Periodic Maintenance (hours)	Major Overhaul (hours)
ARES	1,000 - 4,000	15,000 - 40,000
Conventional Gas Engine	1,000 - 4,000	25,000 - 40,000
Small Turbine	4,000	25,000 - 50,000
Microturbine	5,000	20,000 - 40,000
Fuel Cell	Yearly	40,000 (stack replacement)
PV	Bi-yearly	20-30 years (lifetime)
Wind	Bi-yearly	20 years (lifetime)

Service Support Network History



Service Support

- Engines are most familiar technology to a broad range of customer service personnel.
- Extensive support base in place for engines.
For ARES participants:
 - Over 2,800 U.S. locations to purchase product or parts
 - 6,000+ U.S. service locations

ARES Summary

- Size range is larger than other advanced technologies.
- Efficiency is among the highest.
- Capital cost is among the lowest.
- Extremely compact.
- Builds on long-term product experience and extensive support infrastructure.

Conclusions

- ARES technology will be competitive with other advanced technologies in its application size range.
- High efficiency, compact size, familiarity and user support will all contribute to ARES success.